

Recent Trends in Wood Products Symposium at IPIRI

LIBRARY
16 11-70
MYSORE

A symposium on 'Recent trends in wood products', jointly organized by the Indian Plywood Industries Research Institute (IPIRI), Bangalore and the Indian Academy of Wood Science, was held at the Visvesvaraya Industrial and Technological Museum, Bangalore on 28 and 29 September 1970. Twenty-five papers covering various aspects of wood and wood products research and industry were presented and discussed.

Timber finds nowadays sophisticated engineering applications even in countries like UK, France and Japan which do not have their own timber resources. Some of the papers presented in the symposium emphasized the importance of utilization of timbers of Indian origin for structural purpose. In addition to timbers there are different species of bamboos available in the country. The work carried out at the Forest Research Institute (FRI), Dehra Dun has shown that bamboo can be substituted for steel reinforcement in flat as well as sloped roofs for rural and urban areas.

With the advent of synthetic resin adhesives, a wide variety of structures of varying shape and size can be fabricated from sawn timber and plywood. One of the papers from IPIRI, Bangalore discussed the design of beams, arches and portals, stressed skin panels and glued plywood gussets. The other papers discussed the development of sandwich construction, and the possibility of application of plywood for sophisticated structures which were previously possible only with the use of R. C. C. or steel. A paper from the Central Building Research Institute, Roorkee dealt with the requirements of particle boards as a structural material. Good dimensional stability, low water absorption and

good internal bond strength make particle boards suitable for structural purposes. The cost of production of particle boards is high due to the high cost of synthetic resin adhesives and the development of binderless particle boards is therefore a very attractive proposition. A paper presented from the Regional Research Laboratory, Jorhat described a process of making binderless particle boards.

With increasing industrialization, the problem of corrosion and its prevention is increasing. A paper presented from FRI, Dehra Dun has shown the possibility of the use of timber for large span trusses and other structural components to be used in chemical industries where corrosive conditions prevail.

Research and development in the field of extenders for adhesives is important in view of the increase in the price of synthetic resin adhesives day by day. Even marginal savings in the consumption of resin in plywood and particle board industries would result in considerable savings in the cost of production of panel products. The consumption of resin adhesives can be reduced by incorporating suitable low cost extenders. An attempt to reduce the consumption of phenol-formaldehyde resin in bamboo boards made at FRI, Dehra Dun was reported.

Economic utilization of wood residues such as bark, saw-dust, etc. is of great importance in any wood working industry. It has been estimated that 10-13% of the total content of wood is reduced to saw-dust in milling operations. The largest use of saw-dust and shavings is as fuel. One of the drawbacks in its use as fuel is its bulkiness which necessitates considerable handling and storage space. The obvious

method of overcoming this drawback is to make briquettes by compressing saw-dust with or without a binder. Successful briquetting requires pre-dried material and a method of drying saw-dust was reported in a paper from IPIRI, Bangalore. A related problem is the utilization of bark residues in the forest industries. One of the papers from FRI, Dehra Dun examined the chemistry of waxy material extracted from the bark of spruce. The wax can be used for water-proofing kraft paper, for softening harder waxes and as low grade sealing wax.

The chemistry of lignin, which formed the subject of one of the papers from FRI, Dehra Dun, is of particular significance in the utilization of lignin wastes from paper and pulp industries.

Successful industrial utilization of minor constituents of wood requires the study of the chemistry of these materials. One of the papers from FRI, Dehra Dun dealt with the chemistry of the hydrocarbon fraction of the volatile oil distilled from the heartwood of *Juniperus macropoda*.

A paper from IPIRI, Bangalore reported that the discoloration of rose wood veneers, which has an export market, is caused by oxalic acid produced by fungus of *Aspergillus* sp. A related problem is the attack of wood by termites. A paper from FRI, Dehra Dun described laboratory evaluation of termite resistance of wood and wood products.

Quality control is a technique which must be adopted in the wood products industries for maintaining quality standards throughout the production line. A paper from IPIRI gave an outline of this technique so that the method can be adopted easily in any wood product industry by the existing personnel.

A paper from the Chief Inspectorate of Central Stores, Kanpur out-

lined certain problems of timber stores for defence purposes and their remedy. The development of a half-wrought industry on a cooperative basis was suggested as the solution for this problem.

Steel Industry and its Problems

The second meeting of the Sub-Group on Steel Industry and its Problems was held at the National Metallurgical Laboratory (NML), Jamshedpur on 25 August 1970. The objective of the Sub-Group, formed by the Planning Commission, is to identify problems of steel industry and to provide guidelines to the national laboratories for working out their research and development programmes on the various facets of these problems.

The meeting was attended by representatives from the Hindustan Steel Ltd, Rourkela, Durgapur and Ranchi ; Tata Iron & Steel Co., Jamshedpur ; M. N. Dastur & Co., Calcutta ; the National Metallurgical Laboratory, Jamshedpur ; the Central Glass & Ceramic Research Institute, Calcutta ; and the Department of Atomic Energy.

Welcoming the representatives Prof. V. A. Altekar, Director, NML stressed the importance of identifying the major problems faced by the iron and steel industries. The preparation of the raw materials is one of the main problems confronting the steel plants. With the exploitation of virgin deposits of iron ore and adoption of mechanized mining, the problems of maintaining the proper quality of iron ore suitable for charging in the blast furnace have increased manifold, including utilization of large quantities of iron ore fines. Prof. Altekar also referred to the extensive batch and pilot plant investigations on the beneficiation and agglomeration of iron ores from different sources and the flowsheets developed by NML for their treatment for the benefit of the various steel plants in the country, the National Mineral Development Corporation, etc. He also made a reference to the current work on the beneficiation of iron ore fines from Bailadilla in which considerable progress has been made.

Referring to the problems faced by steel plants on refractory mate-

The effective utilization of the results of research in the wood products industry and the liaison necessary to achieve this result formed the basis of a paper from IPIRI, Bangalore.

rials, Prof. Altekar stated that the real need is now to reassess and re-evaluate the raw materials which are now used. The importance of quality control in the manufacture of refractory products must be assessed by the users before the work on improvement in technology of manufacture of refractory products is taken up. The need for installing processing plants in the new steel plants was stressed. After the process is developed to a certain stage in research laboratories, considerable amount of developmental work can be done in the steel plants.

Dr S. R. Paramanik, Chief Metallurgist, Durgapur Steel Plant, who convened the meeting, apprised the meeting of the various problems of steel industry suggested by the different organizations. Problems were identified and the work that could be taken up in different laboratories towards their solution was discussed. The problems identified for further evaluation are as follows :

1. Raw Materials

(i) Quality survey of iron ores, blast furnace grade limestone and manganese ores and thorough testing of these raw materials including studies on surface measurement of iron ores ; (ii) Sintering and pelletizing characteristics of Indian iron ores particularly Bailadilla ores, design and construction of pelletizing plants in India and comparative study of these two processes for Indian ores ; (iii) Production of high purity iron oxides from iron ore fines and utilization of such ores ; and (iv) Proper utilization of 'blue dust', extent and quality of reserve.

2. Refractories

(i) Development of high quality refractories for electric arc furnaces, vacuum degassing, L-D converters and pitside use ; and (ii) Development of suitable refractory nozzles for continuous casting.

3. Coke ovens

(i) Pilot plant studies on selective preparation of coal charge for coking purposes ; and (ii) charging of pre-dried and/or pre-heated coal in coke ovens.

4. Foundry

(i) Studies on the ingot mould design and its effect on the ingot structure and surface quality for different grades of steel, e. g. killed, semi-killed and rimming ; (ii) Studies on the effects of nitrogen content in iron on the life of ingot mould and its remedial measures ; and (iii) Investigation into the phenomenon of growth in cast iron and its effect on the life of ingot mould.

5. Iron making

(i) Development of low phosphorus pig iron to support expansion of spheroidal graphite cast iron and malleable cast iron industry for the production of high duty castings ; (ii) Computer control of blast furnace process ; (iii) Direct reduction of iron ore ; (iv) Pre-reduction of iron ore fines and stability of such prereduced stock and its uses for steel melting, etc. ; and (v) Electric arc or induction melting of steel from prereduced stock.

6. Steel making

(i) Development of an instrument for continuous temperature measurement in basic oxygen steel making ; (ii) Direct steel from ore with melting assessment of processes ; (iii) Computer control of L-D steel making ; and (iv) Electro-slag refining.

7. Special steels

(i) Demand, if any, of cobalt-free steel and similar steels for nuclear power plants and similar nuclear applications.

8. Shaping

(i) Development of a pilot plant mould for a continuous casting machine for all grades of steel ; and (ii) Development of the synthetic bearing material for the chocks of primary rolling mills.

Polyester Filament Yarn Industry: Sasmira's Survey

A recent survey on polyester filament yarn in India, conducted by the Silk & Art Silk Mills' Research Associat-

ion (Sasmira), Bombay, reveals a promising future in this country for this industry. The survey was undertaken to study the world trend in polyester filament yarn production, the consumer pattern of polyester filament yarn in India, and the prospects of development of this industry.

The survey reveals that polyester filament yarn has made a deep impact on the textile industry in Europe, USA and Japan; polyester filament yarn fabrics and polyester texturized yarn fabrics have been replacing conventional nylon materials. In India the consumption of polyester filament yarn was 41 lakh kg in 1965 and would have registered a steady rise if the ban on the import of polyester filament yarn had not been imposed. There is still a demand for 50, 70, 76, 100 and 105 denier polyester filament yarn in the man-made fibre weaving industry. India offers potentialities of development of the polyester filament yarn industry because of the availability of technical know-how and raw materials.

It recommends that the present producers of polyester filament yarn should be encouraged to expand their production capacity. It is also recommended that besides exploiting the existing know-how and skill of the indigenous units, new units should be established to increase the productive capacity of the industry.

It is suggested that much saving can be effected in foreign exchange if rapid-development of synthetic yarn and fibre industry takes place in the country to meet the clothing demands of the people, for this will cut down the cotton import which is of the order of Rs 95 crores annually. The rapid development of petro-chemical complexes would reduce the country's dependence on imported raw materials for the production of polyester filament yarn in India.

NAL Develops Electronic Desk Calculator

A 12-digit electronic desk top calculator for addition, subtraction, multiplication and division with accumulate product and recall adder function as additional facilities has been designed and developed by the National Aeronautical Laboratory (NAL), Bangalore. The design uses

all integrated circuits, the majority of which belong to the family 7400 series TTL likely to be available indigenously in the country in the near future. The other integrated circuits used in the design to achieve substantial reduction in cost are fully compatible with 7400 series TTL. The calculator uses NAL-developed displays of the miniature 7-segment planar type for display of numbers on the panel. The displays use indigenous lamps specially made to NAL specifications which ensure long operational life. By operating the lamps at considerably below their rated voltage, further increase in lamp life can be obtained. The display drive circuit is a special circuit, which is simple in design and which at the same time brings down the total cost of the machine appreciably.

All operations are fully signed with the sign (+ or -) displayed automatically. Decimal point can be located anywhere on the 12-digit numbers in the fixed point mode, e.g. 123456789012 or 123456789012. In floating point mode, mostly used in scientific calculations, the range of numbers that can be handled is from 10^{-50} to 10^{+49} . If the result of an operation cannot be displayed in fixed point, the calculator will automatically shift to floating point representations. All operations are practically instantaneous, the result being displayed in less than a tenth of a second.

The selling price of NAL-designed desk calculator varies from Rs 3000 to Rs 15 000 depending upon the different versions available, and is comparable to the ex-factory

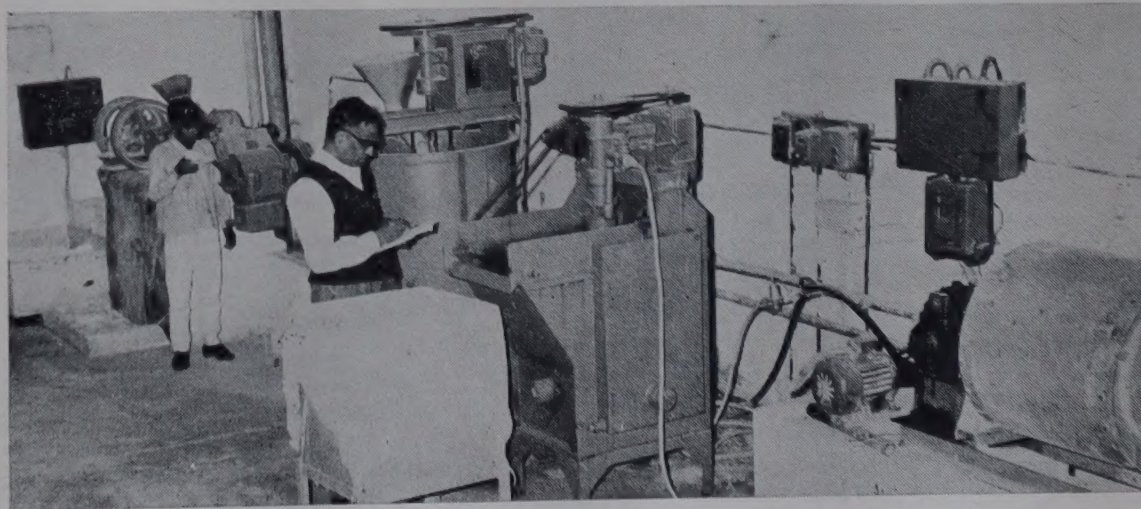
price of imported units. The foreign exchange content of the machine is less than 15% and will be much less when indigenous integrated circuits become available.

The laboratory can offer to industry the technical know-how for calculators of different specifications on a short-term development basis.

Surgical Plaster of Paris from Sub-Standard Gypsum Mineral

Surgical grade plaster of Paris is prepared from naturally occurring hydrous calcium sulphate. This mineral is available in various parts of the country and the property of the plaster of Paris is mostly dependent on the quality of the raw material employed in its preparation. The impurities present in the parent material are carried to the finished plaster unless precautions are taken to remove them before conversion to plaster of Paris. These impurities have to be kept to the minimum to obtain a satisfactory product conforming to pharmacopoeial standards.

The essential requirements of orthopaedic plaster are: pleasing white appearance, smooth surface finish, neither too quick nor too slow setting, uniform rise in temperature, proper expansion and good strength. This plaster calls for high purity mineral or selenite variety of gypsum. Deposits of selenite are not known so far and even the known deposits of gypsum are not of high purity. Large quantities of the mineral as well as orthopaedic plaster were therefore being imported to meet the demands.



Equipment for scaling up the process for beneficiating the gypsum mineral and producing plaster of Paris

The possibility of utilizing the sub-standard gypsum mineral available in Jammu and containing about 3.5% of impurities has been investigated by the Regional Research Laboratory (RRL), Jammu. The Indian Standard Specification for surgical plaster limits the impurities to 1.0% only. The nature of impurities present in the sample was studied and the gypsum mineral was beneficiated by flotation technique using certain chemicals to limit the impurities. The process developed has reduced the impurity to 0.60% and the plaster produced from it conforms to the Indian Standard Specification. The quality of the plaster has been approved by civil and military orthopaedic surgeons. The recovery of the upgraded material is about 80% and a further 5% is possible by a recycling of the rejections. The method developed reduces both the silicate and carbonate impurities. More than two tonnes of the orthopaedic plaster have so far been supplied to the hospitals in the region. Steps are being taken to produce it in quantities sufficient to meet the country's requirements.

Equipment needed for beneficiating the gypsum were indigenously fabricated. The chemicals required for beneficiating the gypsum mineral are available in the country.

Dielectric Investigations on Solid and Liquid Mixtures

The propagation of electromagnetic waves through dielectric powder has been studied by Shri D. C. Dube of the National Physical Laboratory (NPL), New Delhi with a view to developing a correlation between dielectric properties of powders and bulk. The dielectric behaviour of liquid mixtures has also been investigated employing Bottcher's correlation.

Two correlations have been proposed—one for the dielectric constant and the other for dielectric loss factor. The validity of these correlations as well as Bottcher's and Looyenga's formulae has been studied at radio and microwave frequencies under different physical conditions such as particle size and shape, packing density of powders and their dielectric constant and loss.

It has been found that using the proposed formulae for correlating

dielectric parameters of powders and bulk, dielectric constants accurate within 2% and loss factors within 5% can be obtained. Bottcher's formula holds good only for lower dielectric constants ($\cong 7$). Deviations occur for high dielectric values at low packing fractions (< 0.5). For loss factor, inaccuracies of the order of 10-30% have been observed from Bottcher's formula. Of the previously existing correlations, the equation of Landau and Lifshitz and Looyenga has been found to be most accurate. The most appropriate particle size for all the formulae is approximately 50-150 μ . Computed dielectric constant values for finer particles (10-20 μ or below) are lower while the losses are higher when compared to the corresponding values for the normal size (50-150 μ) of particles. The calculated dielectric loss values are lower by about 10-30% than the experimental bulk values. Studies on the dielectric behaviour of liquid mixtures have shown that the Bottcher's formula is applicable to mixtures of both nonpolar liquids and polar-nonpolar mixtures. The dielectric behaviour of the mixtures has been studied and a new method of deducing dipole moment of molecules at infinite dilution has been developed. An algebraic relation has also been formulated which enables the real (vapour) values of the dipole moments to be obtained from the solution values (determined by the use of Bottcher's formula) in the general case of those substances which give the negative solvent effect.

Shri D. C. Dube, who worked under the supervision of Dr R. Parshad of NPL, was awarded the Ph.D. degree of the Delhi University for his thesis entitled 'Dielectric investigations on solid and liquid mixtures'.

Evaporation and Crystallization of Sodium Chloride in Dynamic Conditions

The mechanism of natural evaporation in brine ponds and crystallization of common salt from sea and inland brines in salt works has been studied by Shri G. C. Jain of the Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar. The main findings of the study, which would be useful in the

layout of solar salt works, are as follows:

Evaporation

Evaporation of brine in the condenser is observed to be independent of depth in the solar salt works. However, due to the reflecting surface of the crystallizer bed, the charging has to be made deeper to avail of complete utilization of the available solar heat energy.

Series feeding of brine into the crystallizers is advantageous for obtaining increased rate of evaporation, simplification of the control on the system, as well as to provide two fractions of salt, one rich in calcium sulphate and the other contaminated with magnesium salts, as compared with parallel feeding.

In conventionally prepared crystallizers the dissipation of heat energy on account of percolation and other means accounts for 7-9% of the total energy utilized for evaporation of brine. With a view to minimizing the dissipation of heat energy from the bottom of the crystallizers in salt works, a method of lining the crystallizer bed with the polythene film has been worked out.

Studies have been conducted to understand the mechanism by which addition of trace quantity of magnesium increases the rate of evaporation of brine solutions. It is observed that colloidal manganese hydroxide is formed initially, which is responsible for the increased rate of evaporation. The presence of manganese in the saturated brine also causes the formation of cubical, hard, compact and purer crystals of common salt with low moisture content. Removal of manganese is almost complete from the brine on soda-ash treatment given for the removal of calcium and magnesium ions followed by treatment with a small quantity of ammonia, which forms a complex with manganese and settles down as an insoluble precipitate.

Crystallization of common salt

Other salts present in sea brine do not affect the crystalline form of the separating common salt in the crystallizer. However, physical factors such as depth of brine, raking of salt crystal, and method of extraction of salt crop, etc. affect the physical characteristics of common salt. A

process for the manufacture of high purity salt, which can be used as dairy salt, table salt and kitchen salt, has been developed by suitably adjusting conditions in the solar salt works.

Fortification of common salt with nutrients

Salt being the most suitable vehicle, processes have been developed for the fortification with essential nutrients, viz. calcium as calcium sulphate, iron as iron pyrophosphate (other salts of iron are also being tried), iodine as calcium iodate, etc., during the course of manufacture of salt in the solar salt works, whereby the cost of manufacture of fortified

salt remains almost the same except for the increase due to the cost of nutrients added.

Washing of salt in crystallizers

The process of washing the salt from the crystallizer with saturated brine has been studied in detail and conditions have been worked out for the manufacture of industrial grade salt in the solar salt works.

Shri G. C. Jain, who carried out the research under the guidance of Dr D. S. Datar, the Director, was awarded the Ph.D. degree by the Gujarat University (1970) for the thesis entitled 'Factors affecting evaporation and crystallization of sodium chloride in dynamic conditions'.

CSIR SUPPORT TO RESEARCH

New Schemes

Geochemical and Economic Studies of Refractory Minerals

Under the purview of the Geological and Mineralogical Research Committee, a new scheme will start functioning at the Department of Geology, Banaras Hindu University, Varanasi. Dr S. N. Verma, the principal investigator, proposes to carry out field work in Pipra (Dist. Sidhi, M. P.) in order to obtain some refractory minerals like sillimanite, kyanite and andalusite which find use in iron and steel, copper and aluminium industries. By employing geochemical, petrographic and X-ray methods a proper classification of the rocks and refractory minerals will be made, which can throw light on their genesis.

Petrology, Genesis and Economics of Titanium bearing Vanadiferous Magnetites

The economic extraction of vanadium, an important ferro-alloy metal, from the vanadium bearing magnetites is engaging the attention of scientists. Under the purview of the Geological and Mineralogical Research Committee, Dr A. K. Bhattacharya (principal investigator) proposes to investigate at the Department of Geology, Banaras Hindu University, Varanasi the theoretical aspects of the magnetites which are likely to be of practical utility in the ultimate extraction of vanadium. The studies include

surveys of the magnetite deposits (vanadium content 0.5-0.7%) of Barabar and Nagarjoni Hills near Bela, Gaya Dist. (Bihar), sampling, and petrographic and X-ray investigations of the isolated materials.

Paleomagnetic Studies of Newer Dolerites and Iron Ore Formations of Singhbhum

Paleomagnetic studies of Indian rocks have been confined to Cenozoic, Mesozoic and Permian ages so far, supporting the tentative hypothesis of the continental drift of the Indian landmass since Permian times. Under the purview of the Geological and Mineralogical Research Committee, Dr K. R. Verma of the Indian School of Mines, Dhanbad (Bihar) proposes to undertake detailed paleomagnetic studies of (i) newer dolerites of Singhbhum area (believed to be of Precambrian age); (ii) iron ore formations of Singhbhum (of Precambrian age); and (iii) Gondwana formations of Triassic age from Aurunga and Huttar Coalfields. The study is expected to throw light on the nature of continental drift as well as the geomagnetic field in India during Triassic and Precambrian times.

Fast Coordination Reactions

A new research scheme entitled 'Study of fast coordination reactions' has been granted to Dr P. C. Nigam (principal investigator) of the Department of Chemistry, Indian Institute of Technology, Kanpur by

the Chemical Research Committee. Using fast recorders and stopped flow technique facilities, being developed at the Department, the principal investigator proposes to study the ligand exchange reactions of some aminocarboxylic acids and amines, whose half-lives are not more than a few minutes. This study is likely to lead to the understanding of the exchange reactions occurring in biological systems.

Sensitized Explosive Reactions by Oxidation and Halogenation

The effect of sensitizers in the photochemical combination of hydrogen and halogens resulting in chain reactions has been extensively studied. However, the oxidation and halogenation of saturated and unsaturated hydrocarbons has not received much attention. A new research scheme has been taken up by Dr B. P. Yadava (principal investigator) at the Department of Chemistry, Lucknow University, Lucknow under the purview of the Chemical Research Committee, wherein it is intended to study the role of sensitizers in the oxidation and halogenation of saturated and unsaturated hydrocarbons with special reference to the reactions between methane and oxygen, methane and chlorine, ethylene and oxygen, ethylene and chlorine, acetylene and oxygen, and acetylene and chlorine in the presence as well as absence of sensitizers. The sensitizers to be used are nitrogen peroxide, sulphur dioxide, carbon dioxide and ammonia.

Determination and Separation of Noble Metals

Determination of noble metals like platinum, palladium, rhodium, iridium, ruthenium, gold and osmium in the presence of large quantities of base metals like iron, copper, etc. is a long-standing problem in analytical chemistry. Dr S. C. Shome (principal investigator) has taken up a new research scheme under the purview of the Chemical Research Committee at the Department of Chemistry, Presidency College, Calcutta in which it is proposed to employ some new reagents for the precipitation of the noble metals from the base metals and to introduce specific reagents for their separation. The effect of varying the substituents of the

specific reagent, pH, temperature and oxidation states of the metals in the selective separation of the noble metals will be investigated employing gravimetry and solvent extraction followed by spectrophotometry, complexometry, ion exchange technique and infrared spectroscopy. Experiments will also be conducted to obtain thermodynamic and kinetic data which will be useful in developing new procedures for their separation and determination.

Trans-Esterification Studies

Trans-esterification is a useful reaction in chemical and biochemical preparations since the esters thus prepared are important organic intermediates in chemical, pharmaceutical and plastics industries. Commercially available cation exchangers being good acid catalysts with sieve action are ideal for trans-esterification purposes. Under the purview of the Chemical Research Committee, Dr I. M. Mathai (principal investigator) of the Madras Christian College, Madras proposes to try several imported and indigenous cation exchangers over a wide range of temperatures to achieve trans-esterification.

Completed Schemes

Studies on Khondalite Series of Salur-Bobbili Area

A CSIR scheme entitled 'Studies on Khondalite series of Salur-Bobbili area' functioning at the Department of Geology, Sri Venkateswara University, Tirupati has been completed. The research team comprised Prof. M. G. Chakrapani Naidu and Shri J. Jagannatha Rao, a CSIR research fellow (1965-68).

The Salur-Bobbili area investigated is a part of Srikakulam Dist. in Andhra Pradesh lying between north latitudes $18^{\circ}38'30''$ and $18^{\circ}30''$, east longitudes $83^{\circ}8'45''$ and $83^{\circ}23'$ in the Survey of India topographic sheets (No. 65N/2) covering 140 sq. miles.

The rock formations in the area represent highly metamorphosed rocks formed during the Archaean era, comprising the Khondalite series, the Porphyroblast gneisses, the Charnockite series and the Leptynites. The field distribution and inter-relationship, petrography,

mineralogy and petrochemistry of the rock types have been studied. From the structural point of view, the area is represented by strongly foliated rocks. The strike of foliation of the rock formations is variable ranging from NNW-SSE to NNE-SSW. Most of the rock types are jointed and at least three sets of prominently developed joints have been observed. This notable variation in the strike of foliation and the presence of numerous joints suggest that the rocks of the area have been subjected to compressional forces acting in different directions.

The Khondalite series of rocks are represented in this area by argillaceous, arenaceous, calcareous and manganiferous members. It is represented by regionally metamorphosed rocks, originally sedimentary, formed under the pressure and temperature conditions of the pyroxene-granulite sub-facies of granulite facies of regional metamorphism. The banded and foliated nature of the rocks indicates intense plastic movement to which they have been subjected.

The mineralogical banding in the rocks is considered to be due to differences in the composition of the original sediments. The presence of cordierite in the argillaceous sandstone indicates that the rocks were subjected to regional metamorphism.

From a detailed study of the manganese ores it is suggested that they were deposited as chemical precipitates with varying proportions of iron and manganese and are later metamorphosed along with the associated rock types. The presence of minerals, such as wollastonite and cordierite in some of the members suggest that they were formed under relatively high temperatures and low pressures thereby indicating that the metamorphism was transitional between pyroxene-granulite sub-facies and pyroxene-hornfels facies.

The Porphyroblast gneisses of the area are represented by rocks which are characterized by the presence of euhedral to subhedral feldspar porphyroblasts. They show distinct foliation. Idioblastic feldspars are sometimes arranged parallel or sub-parallel to each other to impart a lineation to these rocks. The foliation is conformable with the adjoining Khondalite series of rocks.

The Porphyroblasts are considered to have been formed due to recrystallization under stresses and temperatures of the granulite facies. It is concluded that the Porphyroblast gneisses are formed under the pressure-temperature conditions of the granulite facies and later subjected to retrogressive metamorphism, resulting in the development of biotite. It is considered that the original granitic rocks of the area have been largely modified, partly by assimilating portions of the early formed Khondalite series of rocks and also by the later charnockitic intrusions, resulting in the formation of Porphyroblast gneisses. It is visualized that the Porphyroblast gneisses are formed by the interaction of an earlier granitic phase and a later charnockitic phase. However, earlier it was considered that the first igneous episode after the formation of the Khondalite series of rocks is represented by the emplacement of the Charnockite magma, the Porphyroblast gneisses being the feldspathized equivalents of Charnockites.

The Charnockite series of rocks are represented by basic, intermediate and acid members. While the basic members show definite localities relationship to the paragneisses at different localities, the acid and intermediate members occur as hillocks at different places and do not show any intrusive relationship. The petrochemical studies of the Charnockite series of rocks indicate that the parent rocks had essentially a composition comparable to those of the calc-alkali series of plutonic rocks. Petrographical and mineralogical studies indicate that the rocks were subjected to a high grade metamorphism corresponding to the granulite facies after their formation and were later on subjected to retrograde metamorphism. These Charnockites do not show any evidence of being considered as originally sedimentary rocks. On the other hand, a study of the coexisting pyroxenes from the rocks of this series in the light of the recent work by Kretz, Ramberg, and Binns, as well as a study of the plagioclase twins from these rocks, indicates a metamorphic origin for the Charnockite series of rocks.

The leptynites, which are quartzo-feldspathic and garnetifer-

ous in composition, are mostly associated with the Khondalites and Charnockites and are of a hybrid or reconstituted type. These are characterized by a granoblastic texture, general presence of garnet and a granitic composition and appear to represent the various stages of hybridism and reconstitution of the Khondalites by the Charnockites. The mineral assemblage and texture suggest that the leptynites have been subjected to a high grade metamorphism and that the rocks have attained equilibrium conditions under the pyroxene-granulite sub-facies of

the granulite facies of metamorphism. From a critical study of these rocks, leptynites are considered to be mineralogically reconstituted Khondalites with an admixture of Charnockitic melt, the reconstitution of the leptynites having been probably effected during the Eastern Ghats orogeny.

Shri J. Jagannatha Rao was awarded the Ph. D. degree of Sri Venkateswara University (1970) for his thesis entitled 'Studies on Khondalite series of Salur-Bobbili area'.

Built-in-Lubrication Process for Improving Tensile and Tear Strength of Fabrics: SRI's Development

With the advent of synthetic fibres, wash-and-wear or easy-care cotton materials have received a great impetus. During the last 40 years, hundreds of products and processes have been developed to improve resilience and crease resistance of cellulosic textiles with or without the formation of polymeric substances in and around the fibre substance. Further, in all the processes there is a substantial loss of tensile, tear and abrasion properties. These losses appear to be inevitable according to a large number of research workers in the field.

In practice a compromise has been arrived at either by choosing fabrics of higher initial strength or by incorporating lubricating agents and softeners in the treatment baths. However, the resulting finishes suffer from poor wash-fastness and lack of comfort characteristics.

With a view to finding a solution to the problem of strength losses, the Shri Ram Institute for Industrial Research (SRI), Delhi has been carrying out intensive research under a CSIR-aided project. The study led in 1963 to a novel idea of providing built-in-lubrication (BIL) during the cross-linking reaction of cellulose whereby a bifunctional compound containing a bulky lubricating chain within its structure is made to react chemically with cellulose. It was found that as the size of the substituent group increases, there is a definite improvement in tensile and tear strength.

Further intensive work during 1963-65 was therefore directed towards developing suitable methods of synthesis of the new compounds and also for establishing conditions of fabric treatment which would be practical and easy to apply under mill conditions.

The new process has been patented in UK, USA and India.

The process

The process consists in treating cotton textiles with the stearyl ester of 1,3-dichloro-2-propanol. The ester is synthesized in the usual manner from glycerol or epichlorohydrin by hydrochlorination followed by esterification. The textile treatment process consists in applying an aqueous emulsion of the ester followed by drying and further treatment with cold mercerizing caustic soda solution. The advantages of the process are as follows: (1) It is easy of application as well as control; (2) the chemicals required are easily available; (3) abrasion resistance can be improved by 200-400%; (4) fabrics subjected to the treatment form an excellent base material for applying cross-linking agents/resins; (5) the finish is wash-fast; (6) the handle and drape of the fabric are unaffected; and (7) the hydrophilic and breathing characters of the fabric are unaffected.

Scope of application

Large scale mill trials of the basic process as well as of the production

of wash-and-wear garments have been completed. There is further scope for extending the application of the new process to hosiery materials, sarees, military uniforms, bed sheets, sewing threads and many other varieties of fabric. It is proposed to evaluate the suitability of the process for the treatment of all types of fabrics and yarns.

Pilot scale trials

The chemicals required for the process are not normally available and it was, therefore, necessary to standardize conditions of synthesis and emulsification. Large scale batches, 50 kg at a time, are being prepared at the Institute and supplied to the interested mills. Large quantities of fine and superfine poplins as well as various other fabrics have been treated in a few mills in India. The extensive trials carried out in the mills have shown that it is possible to improve abrasion resistance by 200-400% and tear strength by 15-25% of normally finished fabrics. In the case of wash-and-wear finished fabrics, tensile strength also is improved by 10-15% in addition to the above properties.

Field wear trials

Under a special programme sponsored by PL-480 authorities, five controlled field wear trials of apparels treated with BIL as well as BIL plus wash-and-wear finish were carried out to assess the improvement in flex abrasion resistance keeping in view the various end uses as in school boys' garments, office goers' clothes and ladies' domestic wear. The trials have shown that the BIL process results in 25-50% increase in wear life.

Raw materials

The main raw materials required for the process are epichlorohydrin, stearic acid and the usual condensing agents. One or two of these chemicals are not manufactured in India, but there should be no difficulty in making them or importing small quantities as required.

Equipment

The padding with the BIL emulsion and drying of fabric can be conveniently carried out on the conventional stenters. The caustic soda treatment is best carried out on pad chain

mercerizing machine provided with a variable speed drive and batching arrangement or Bentler type open width bleaching range or Cumario type open soaper provided with a batching arrangement. The rest of the operations can be effectively carried out on conventional machinery available in modern mills.

Economics of process

The emulsion required in the treatment is supplied by SRI at about Rs 3.50/kg and the cost of fabric (conventional medium poplin) treatment on this basis works out to Rs 3.23/kg or Re 0.32/m. With the increase in consumption of the emulsion its cost could be brought down.

Parties interested in undertaking the commercial development of the above process are requested to correspond with the Executive Director, National Research Development Corporation of India, Mandi House Lytton Road, New Delhi.

The reaction of the chemical with cellulose in the presence of caustic soda in the present process is carried out at room temperature for a period of up to 24 hr. This has been found to be inconvenient from the production point of view. The possibility of making the BIL process simple and continuous is being explored. Preliminary results are encouraging.

Delhi Cloth Mills, Delhi have signed an agreement with the National Research and Development Corporation of India for utilizing the process. Development work in Shree Ram Mills, Bombay, Bombay Dyeing and Manufacturing Co. Ltd, Bombay, and Standard Mills, Bombay is in progress.

Symposium on Earthquake Engineering

The fourth symposium on Earthquake Engineering will be held at the University of Roorkee, Roorkee from 14 to 16 November 1970 (*CSIR News*, Vol. 19, p. 168). Some sixty papers will be presented and discussed in the following areas: observations during earthquakes; instrumentation for vibration studies; behaviour of different structures like

buildings, bridges, dams and other special structures during earthquakes; soil and foundation behaviour during earthquakes; seismology; wave propagation; and seismotectonics. About 200 delegates including some 25 from overseas are expected to participate.

Obituary

Prof. P.S. Sarma

We record with deep regret the sudden demise of Prof. P.S. Sarma, Professor of Biochemistry, Indian Institute of Science (I.I. Sc.), Bangalore on 8 September 1970 at Interlaken, Switzerland, where he had been to attend the Eighth International Congress of Biochemistry.

Born on 29 October 1917 at Kasargod (Kerala), Padubiri Subbaraya Sarma had a brilliant academic career at St Joseph's College, Bangalore and Presidency College, Madras, and joined the Department of Biochemistry, I.I.Sc., Bangalore in 1938. He got the M.Sc. degree of the Madras University for his studies on insect nutrition, which also won him the Curzon Prize of the University in 1941. After working as a research assistant in the Nutrition Research Laboratories, Cooranoor during 1942-44, Sarma proceeded to USA for higher studies and obtained the Ph. D. degree of the Wisconsin University (1946) for his studies on the relationship between tryptophan and nicotinic acid. He later worked at the Harvard University as a post-doctoral fellow. He rejoined the Nutritional Research Laboratories, Cooranoor and moved to the University of Madras where he built up an active school of biochemical research as Professor and Director of the University Biochemical Laboratory. The contributions from this laboratory on the biosynthesis and degradation of phosphoproteins are well known. The work of Prof. Sarma and his associates on the biosynthesis of nicotinic acid coenzyme derivatives led to the understanding of the role of nicotinamide deamidase and the nicotinamide mononucleotide deamidase in the control of the biosynthesis of these coenzymes in microorganisms and mammalian tissues respectively.

Returning to the Indian Institute of Science, Bangalore as Professor of Biochemistry in 1959 he built up another active centre of biochemical research as a result of which the Department has been recognized as a Centre of Advanced Study in Biochemistry by the University Grants Commission.

Prof. Sarma's fields of study included the metabolism of trace elements, particularly cobalt and iron, and production of fatty liver in rats by orotic acid. Recently, he and his associates isolated and characterized two new amino acids from *Kesari dal* (*Lathyrus sativus*), viz. L-homoarginine and β -N-oxalyl-L- α , β -diaminopropionic acid (ODAP), the latter being identified as the principle in *Kesari dal* responsible for neurolathyrism endemic in Central India.

Among the several honours and awards conferred on Prof. Sarma mention may be made of the travel fellowship of the Rockefeller Foundation of New York to visit biochemical research centres in UK, USA and Canada in 1957; Watumull Award in 1965; visiting fellowship of the Australian National University in 1967 and chairmanship of the session on Plant Products of the International Congress of Biochemistry (New York, 1969). Prof. Sarma was member of the American Institute of Nutrition, Washington; Society of Experimental Biology & Medicine, USA; and the Indian National Committee of the International Union of Biochemistry. He was Fellow of the Indian National Science Academy, the Indian Academy of Sciences, and the Royal Institute of Chemistry, London. He was also President, Society of Biological Chemists (India) during 1962-64.

Prof. Sarma was intimately associated with CSIR in several capacities. He was member of the Chemical Research Committee and was investigator in charge of several CSIR research schemes being worked at the Institute. Prof. Sarma was associated with the Publications & Information Directorate of CSIR as the member of the editorial boards of *Indian Journal of Chemistry* and *Indian Journal of Biochemistry*.